

Serial No. 10/720,631
Docket H-205755

IN THE CLAIMS

The following listing of claims will replace all prior versions, and listings, of claims in the present application:

1. (Original) A fuel cell system comprising:
 - a proton exchange membrane having a first face and a second face;
 - a cathode catalyst layer overlying the first face of the proton exchange membrane;
 - a cathode diffusion layer overlying the cathode catalyst layer;
 - an anode catalyst layer overlying the second face of the proton exchange membrane;
 - an anode diffusion layer overlying the anode catalyst layer;wherein the cathode diffusion layer has a water vapor permeance of less than about 3×10^{-4} g/(Pa s m²) at 80°C and 1 atmosphere.
2. (Original) The fuel cell system of claim 1 wherein the water vapor permeance of the cathode diffusion layer is less than about 2×10^{-4} g/(Pa s m²) at 80°C and 1 atmosphere.
3. (Original) The fuel cell system of claim 1 wherein the water vapor permeance of the cathode diffusion layer is less than about 1.5×10^{-4} g/(Pa s m²) at 80°C and 1 atmosphere.
4. (Original) The fuel cell system of claim 1 wherein a water vapor permeance of the anode diffusion layer is greater than about 3×10^{-4} g/(Pa s m²) at 80°C and 1 atmosphere.
5. (Original) The fuel cell system of claim 1 wherein the water vapor permeance of the cathode diffusion layer is between about 10 and about 50% of a water vapor permeance of the anode diffusion layer.
6. (Original) The fuel cell system of claim 1 wherein a thickness of the cathode diffusion layer is less than about 1000 microns.

Serial No. 10/720,631
Docket H-205755

7. (Original) The fuel cell system of claim 6 wherein the thickness of the cathode diffusion layer is in a range of about 150 to about 600 microns.

8. (Original) The fuel cell system of claim 7 wherein a thickness of the anode diffusion layer is in a range of about 75 to about 200 microns.

9. (Original) The fuel cell system of claim 6 wherein a bulk density of the cathode diffusion layer is less than about 2.0 g/cc.

10. (Original) The fuel cell system of claim 9 wherein the bulk density of the cathode diffusion layer is in a range of about 0.4 to about 0.8 g/cc.

11. (Original) The fuel cell system of claim 6 wherein a porosity of the cathode diffusion layer is greater than about 25%.

12. (Original) The fuel cell system of claim 11 wherein the porosity of the cathode diffusion layer is in a range of about 50% to about 80%.

13. (Original) The fuel cell system of claim 6 wherein the cathode diffusion layer contains between about 5 wt% to about 15 wt% polytetrafluoroethylene.

14. (Original) The fuel cell system of claim 1 wherein a ratio of a thickness of the cathode diffusion layer to a thickness of the anode diffusion layer is between about 20:1 to about 3:1.

15. (Original) The fuel cell system of claim 1 wherein a bulk density of the cathode diffusion layer is less than about 2.0 g/cc.

16. (Original) The fuel cell system of claim 15 wherein the bulk density of the cathode diffusion

Serial No. 10/720,631
Docket H-205755

layer is in a range of about 0.4 g/cc to about 0.8 g/cc.

17. (Original) The fuel cell system of claim 16 wherein a bulk density of the anode diffusion layer is in a range of about 0.15 g/cc to about 0.5 g/cc.

18. (Original) The fuel cell system of claim 15 wherein a thickness of the cathode diffusion layer is less than about 1000 microns.

19. (Original) The fuel cell system of claim 18 wherein the thickness of the cathode diffusion layer is in a range of about 150 to about 600 microns.

20. (Original) The fuel cell system of claim 15 wherein a porosity of the cathode diffusion layer is greater than about 25%.

21. (Original) The fuel cell system of claim 20 wherein the porosity of the cathode diffusion layer is in a range of about 50% to about 80%.

22. (Original) The fuel cell system of claim 15 wherein the cathode diffusion layer contains between about 5 wt% to about 15 wt% polytetrafluoroethylene.

23. (Original) The fuel cell system of claim 1 wherein a ratio of a bulk density of the cathode diffusion layer to a bulk density of the anode diffusion layer is between about 20:1 and about 1.5:1.

24. (Original) The fuel cell system of claim 1 wherein a porosity of the cathode diffusion layer is greater than about 25%.

25. (Original) The fuel cell system of claim 24 wherein the porosity of the cathode diffusion layer is in a range of about 50% to about 80%.

Serial No. 10/720,631
Docket H-205755

26. (Original) The fuel cell system of claim 25 wherein a porosity of the anode diffusion layer is in a range of about 70% to about 90%.

27. (Original) The fuel cell system of claim 24 wherein a thickness of the cathode diffusion layer is less than about 1000 microns.

28. (Original) The fuel cell system of claim 27 wherein the thickness of the cathode diffusion layer is in a range of about 150 to about 600 microns.

29. (Original) The fuel cell system of claim 24 wherein a bulk density of the cathode diffusion layer is less than about 2.0 g/cc.

30. (Original) The fuel cell system of claim 29 wherein the bulk density of the cathode diffusion layer is in a range of about 0.4 to about 0.8 g/cc.

31. (Original) The fuel cell system of claim 24 wherein the cathode diffusion layer contains between about 5 wt% to about 15 wt% polytetrafluoroethylene.

32. (Original) The fuel cell system of claim 1 wherein a ratio of a porosity of the cathode diffusion layer to a porosity of the anode diffusion layer is between about 1:3.8 and about 1:1.25.

33. (Original) The fuel cell system of claim 1 wherein the cathode diffusion layer contains at least about 0.25 wt% polytetrafluoroethylene.

34. (Original) The fuel cell system of claim 33 wherein the cathode diffusion layer contains in a range of about 5 wt % to about 15 wt% polytetrafluoroethylene.

35. (Original) The fuel cell system of claim 34 wherein the anode diffusion layer contains in a

Serial No. 10/720,631
Docket H-205755

range of about 3 wt % to about 10 wt% polytetrafluoroethylene.

36. (Original) The fuel cell system of claim 33 wherein a thickness of the cathode diffusion layer is less than about 1000 microns.

37. (Original) The fuel cell system of claim 36 wherein the thickness of the cathode diffusion layer is in a range of about 150 to about 600 microns.

38. (Original) The fuel cell system of claim 33 wherein a bulk density of the cathode diffusion layer is less than about 2.0 g/cc.

39. (Original) The fuel cell system of claim 38 wherein the bulk density of the cathode diffusion layer is in a range of about 0.4 to about 0.8 g/cc.

40. (Original) The fuel cell system of claim 33 wherein a porosity of the cathode diffusion layer is greater than about 25%.

41. (Original) The fuel cell system of claim 40 wherein the porosity of the cathode diffusion layer is in a range of about 50% to about 80%.

42. (Original) The fuel cell system of claim 1 wherein the proton exchange membrane remains fully hydrated during operation of the fuel cell system without use of an external cathode hydration system.

43. (Original) A fuel cell system comprising:

- a proton exchange membrane having a first face and a second face;
- a cathode catalyst layer overlying the first face of the proton exchange membrane;
- a cathode diffusion layer overlying the cathode catalyst layer;
- an anode catalyst layer overlying the second face of the proton exchange membrane;

Serial No. 10/720,631
Docket H-205755

an anode diffusion layer overlying the anode catalyst layer;

wherein the cathode diffusion layer has a water vapor permeance of less than about 3×10^{-4} g/(Pa s m²) at 80°C and 1 atmosphere, and wherein a thickness of the cathode diffusion layer is less than about 1000 microns, and wherein a bulk density of the cathode diffusion layer is less than about 2.0 g/cc, and wherein a porosity of the cathode diffusion layer is greater than about 25%.

44. (Original) The fuel cell system of claim 43 wherein the thickness of the cathode diffusion layer is in a range of about 150 to about 600 microns.

45. (Original) The fuel cell system of claim 43 wherein the bulk density of the cathode diffusion layer is in a range of about 0.4 to about 0.8 g/cc.

46. (Original) The fuel cell system of claim 43 wherein the porosity of the cathode diffusion layer is in a range of about 50% to about 80%.

47. (Original) The fuel cell system of claim 43 wherein the cathode diffusion layer contains in a range of about 5 to about 15 wt% polytetrafluoroethylene.

48. (Original) A cathode diffusion layer for a fuel cell system comprising:

a cathode diffusion layer containing less than 15 wt% polytetrafluoroethylene and having a water vapor permeance of less than about 3×10^{-4} g/(Pa s m²) at 80°C and 1 atmosphere.

49. (Original) The cathode diffusion layer of claim 48 wherein the water vapor permeance of the cathode diffusion layer is less than about 2×10^{-4} g/(Pa s m²) at 80°C and 1 atmosphere.

50. (Original) The cathode diffusion layer of claim 48 wherein the water vapor permeance of the cathode diffusion layer is less than about 1.5×10^{-4} g/(Pa s m²) at 80°C and 1 atmosphere.

Serial No. 10/720,631
Docket H-205755

51. (Original) The cathode diffusion layer of claim 48 wherein a thickness of the cathode diffusion layer is less than about 1000 microns.

52. (Original) The cathode diffusion layer of claim 51 wherein the thickness of the cathode diffusion layer is in a range of about 150 microns to about 600 microns.

53. (Original) The cathode diffusion layer of claim 48 wherein a bulk density of the cathode diffusion layer is less than about 2.0 g/cc.

54. (Original) The cathode diffusion layer of claim 53 wherein the bulk density of the cathode diffusion layer is in a range of about 0.4 to about 0.8 g/cc.

55. (Original) The cathode diffusion layer of claim 48 wherein a porosity of the cathode diffusion layer is greater than about 25%.

56. (Original) The cathode diffusion layer of claim 55 wherein a porosity of the cathode diffusion layer is in a range of about 50 % to about 80%.

57. (Original) The cathode diffusion layer of claim 48 wherein the cathode diffusion layer contains in a range of about 5 wt % to about 15 wt% polytetrafluoroethylene.

58. (Original) A cathode diffusion layer for a fuel cell system comprising:
a cathode diffusion layer having a water vapor permeance of less than about 3×10^{-4} g/(Pa s m²) at 80°C and 1 atmosphere, and wherein a thickness of the cathode diffusion layer is less than about 1000 microns, and wherein a bulk density of the cathode diffusion layer is less than about 2.0 g/cc, and wherein a porosity of the cathode diffusion layer is greater than about 25%.

59. (Original) The cathode diffusion layer of claim 58 wherein the water vapor permeance of the

Serial No. 10/720,631
Docket H-205755

cathode diffusion layer is less than about $2 \times 10^{-4} \text{ g}/(\text{Pa s m}^2)$ at 80°C and 1 atmosphere.

60. (Original) The cathode diffusion layer of claim 58 wherein the water vapor permeance of the cathode diffusion layer is less than about $1.5 \times 10^{-4} \text{ g}/(\text{Pa s m}^2)$ at 80°C and 1 atmosphere.

61. (Original) The cathode diffusion layer of claim 58 wherein the thickness of the cathode diffusion layer is in a range of about 150 microns to about 600 microns.

62. (Original) The cathode diffusion layer of claim 58 wherein the bulk density of the cathode diffusion layer is in a range of about 0.4 to about 0.8 g/cc.

63. (Original) The cathode diffusion layer of claim 58 wherein a porosity of the cathode diffusion layer is in a range of about 50% to about 80%.

64. (Original) The cathode diffusion layer of claim 58 wherein the cathode diffusion layer contains in a range of about 5 wt % to about 15 wt% polytetrafluoroethylene.